

Oribatid Mites from Tropical Forests of Yunnan Province in China

II. Families Galumnidae and Galumnellidae

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ABSTRACT—One new genus, seven new species and two new subspecies of oribatid mites belonging to the families Galumnidae and Galumnellidae are described from Yunnan Province of southern China: *Kinezogalumna calcicola* gen. n. et sp. n., *Pergalumna menglunensis* sp. n., *P. imadatei* sp. n., *P. magnipora xishuangbanna* subsp. n., *P. intermedia retroversa* subsp. n., *Galumna weni* sp. n., *Acrogalumna bipartita* sp. n., *Cosmogalumna imperfecta* sp. n. and *Porogalumnella pulchella* sp. n.

The first report on oribatid mites of Yunnan dealing with the family Lohmanniidae [16] is succeeded here by the present paper dealing with the families Galumnidae and Galumnellidae. It appears to be one of the characteristic feature of oribatid fauna in Yunnan Province that the galumnoid mites (superfamily Galumnoidea) are much abundant both in the density and in the number of species. All the galumnoids collected in the tropical forests (the stations: xi-1, xi-2, xi-3 and xi-4) of Xishuangbanna of Yunnan are found to be new species or new subspecies, which are described below. A new genus is elected for one of the new species.

DESCRIPTION

Family Galumnidae

Kinezogalumna gen. n.

Diagnosis. Prodorsum on each side with a lateral carina S and a short, well sclerotized lamellar ridge, on which lamellar seta is inserted. Dorsosejugal suture incomplete medially. Sensilli long, without a strongly swollen head. Genital plates with 6 pairs of setae. Notogaster with 4 pairs of areae porosae. Legs heterotridactyle.

In the position of lamellar setae (seta *le* is

inserted just behind lamellar carina *L*), the genera *Galumna* and *Kinezogalumna* are similar to each other. In the genus *Galumna*, however, the lamellar carina *L* forms only a thin curved line parallel to the carina *S*, while in the genus *Kinezogalumna* the lamellar carina *L* constitute a short broad ridge which is strongly sclerotized. The long sensilli which are directed backward with an elbow are also peculiar to the new genus.

Type species: *Kinezogalumna calcicola* sp. n.

Kinezogalumna calcicola sp. n.

(Figs. 1-5)

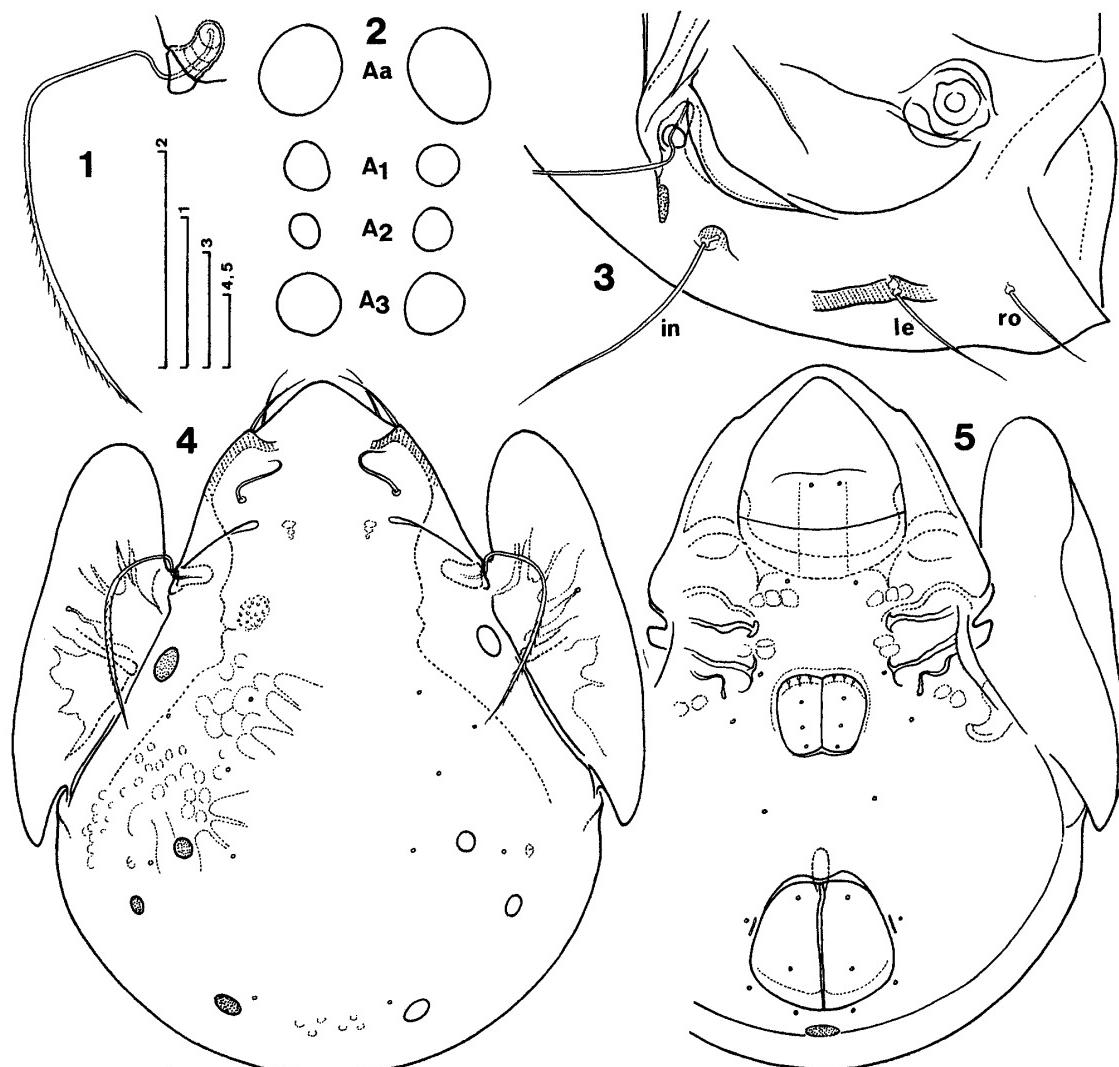
Measurement. Body length 284-288 μm , width 220-227 μm .

Prodorsum. Prodorsal setae thin and nearly smooth; relative length of them—*ro:le:in* = (1.0); (1.2-1.3); (1.8-1.9); seta *in* winding and directed upward. On the lateral side of prodorsum, in front of carina *S*, found a short but distinct lamellar ridge; seta *le* inserted near the anterior (ventral) extremity of the ridge. Sensillus very long and setiform, being directed laterad and then bending backward, the apical half being slightly thickened and barbed unilaterally (Fig. 1).

Notogaster. Dorsosejugal suture incomplete medially, only discernible between bothridium and area porosa *Ad* on each side; *Ad* elongate drop-shaped. Four pairs of notogastral areae porosae rounded, *Aa* the largest and *Aa* (sometimes *A1* and

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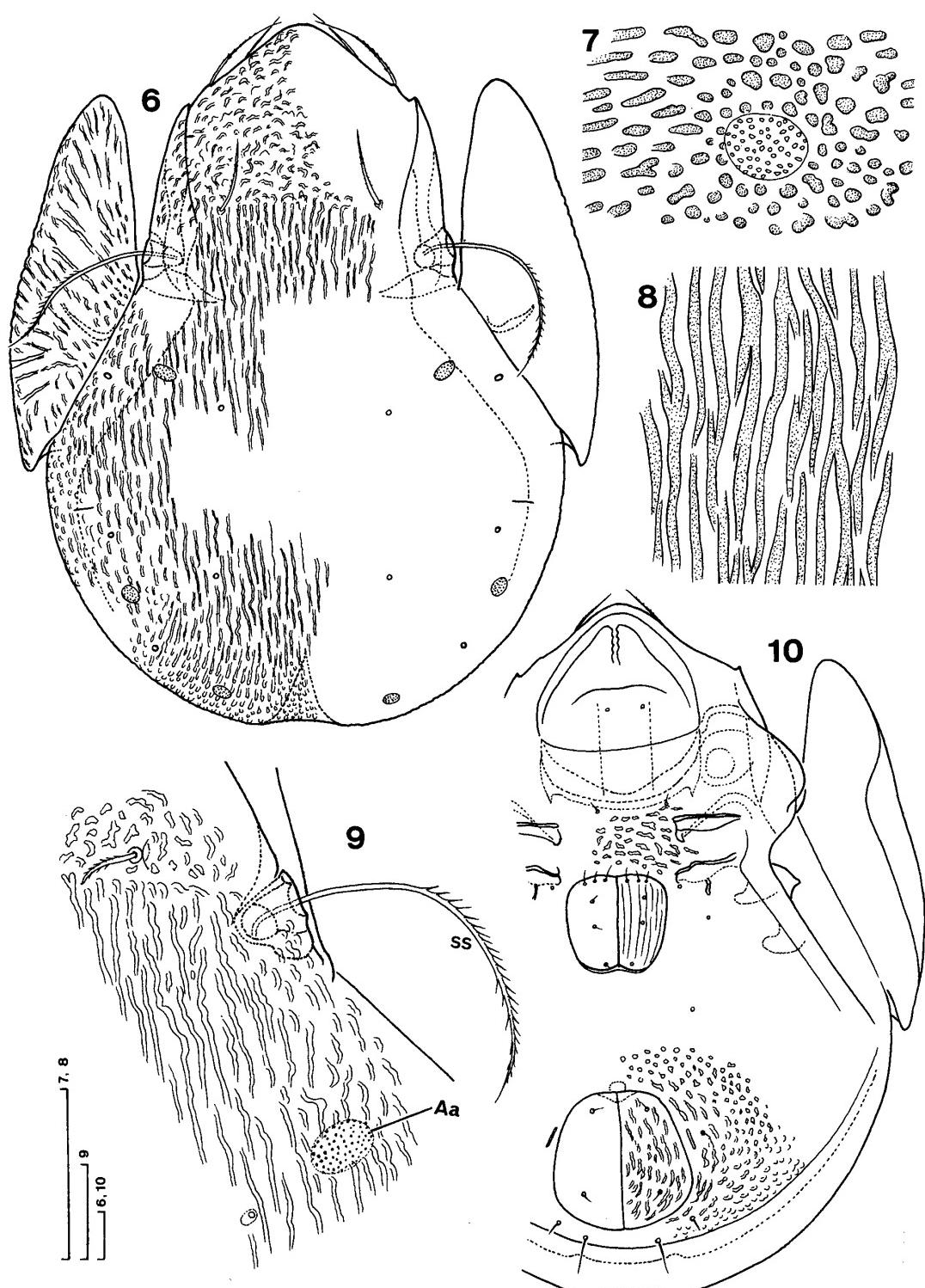
Figs. 1–5. *Kinezogalumna calcicola* sp. n. 1 Sensillus. 2 Areae porosae on notogaster. 3 Lateral view of prodorsum. 4 Dorsal side. 5 Ventral side. Bars, 30 μ m.

A_2) the smallest ($Aa > A_3 > A_1 \geq A_2$, Fig. 2). Notogastral setae invisible, only their alveoli detected. No central pore present. Notogastral surface showing indistinct pattern of network or radiating lines in front of areae porosae A_1 .

Anogenital region. Formula of anogenital setae: 6–1–2–3. Both genital and anal aperture slightly wider than long. Mutual distance of aggenital setae longer than the width of genital aperture and shorter than that of anal one; setae *ag* situated a little anterior to the level mid-distance along the interspace of the both apertures. Adanal seta *ad* situated just outside adanal fissure *iad* or a little more anteriorly. An elliptical area porosa *Ap*

located posterior to anal opening.

Holotype and 12 paratypes: Tropical limestone forest (natural forest) in Menglun, Xishuangbanna (xi-4), 30-X-1992.—2 paratypes: Tropical rain forest (secondary forest) in Xishuangbanna Tropical Botanic Garden in Menglun (xi-3), 28-X-1992. All in Yunnan Province in China, collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 921) and 8 paratypes (SIE-Ori 922–929) are deposited in the collection of Shanghai Institute of Entomology, Academia Sinica, Shanghai and the remaining paratypes (NSMT-Ac 10451–10452) in the collection of National Science Museum, Tokyo.



Figs. 6–10. *Pergalumna menglunensis* sp. n. 6 Dorsal side. 7 Surface structure around area porosa A_1 . 8 Surface structure on the middle part of notogaster. 9 Bothridium with sensillus and their vicinity. 10 Ventral side. Bars, 30 μm .

Pergalumna menglunensis sp. n.
(Figs. 6–10)

Measurement. Body length 408–485 μm , width 298–352 μm .

Prodorsum. Rostrum rounded in dorsal view. Setae *ro* and *le* weakly barbed unilaterally; seta *in* inserted on a small apophysis; seta *in* as long as *le*, slightly barbed. Surface of prodorsum ornamented by short, irregular ridges arranged in various directions. Sensillus long, curved posteriad, with distinct spines (about 20–25 in the number) on the outside in distal half of sensillus and a few spines (about 5–8 in the number) on the inside in distal one third of sensillus.

Notogaster. Dorsosejugal suture absent, but its assumptive position noticed by the change of surface structure; short irregular ridges on prodorsum changing on notogaster to long, longitudinally arranged ridges; the ridges flowing smoothly, weakly winding, branching and vanishing here and there (Fig. 8). No notogastral setae visible, but alveoli distinct, each with a dark ring. Three pairs of areae porosae; the anterior and middle ones similar in size, the posterior one somewhat smaller. Longitudinal ridge-like ornamentation becoming shorter and rather granule-like posteriorly around middle and posterior areae porosae (Fig. 7). Usually with a median pori. Pteromorpha with striation of irregular ridges.

Anogenital region. Formula of anogenital setae: 6–1–2–3. Genital plate longitudinally striated with 7–8 striae. Genital seta *g*₁ inserted close to the posterior margin and *g*₄–*g*₆ on the anterior margin of genital plate. Anal, epimeral and ventral plate ornamented with short irregular ridges. Adanal seta *ad*₁ 2–3X as long as *ad*₂; seta *ad*₃ the shortest. Adanal fissure *iad* situated between seta *ad*₃ and lateral margin of anal plate. Legs heterotridactyle.

Holotype and 5 paratypes: Tropical limestone forest (natural forest) in Menglun, Xishuangbanna (xi-4 and xi-5), 30-X-1992.—21 paratypes: Tropical rain forest (natural forest) in Xishuangbanna Tropical Botanic Garden, Menglun (xi-2), 28-X-1992.—2 paratypes: Tropical rain forest (secondary forest) in Xishuangbanna Tropical Botanic Garden, Menglun (xi-3), 28-X-1992. All the specimens collected by J. Aoki and S.-h. Hu. The

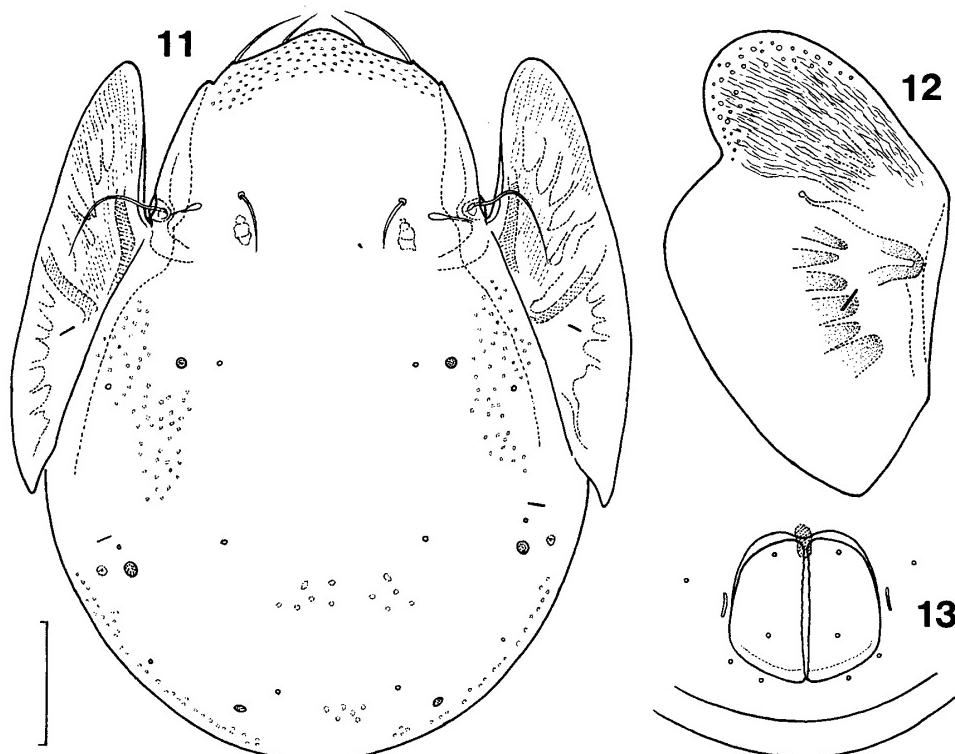
holotype (SIE-Ori 9210) and 18 paratypes (SIE-Ori 9211–9216) are deposited in the collection of Shanghai Institute of Entomology and 10 paratypes (NSMT-Ac 10453–10455) in the collection of National Science Museum, Tokyo.

Remarks. Several known species of the genus *Pergalumna* have dorsal ornamentation of longitudinal ridges as in the new species. *Pergalumna margaritata* Mahunka, 1989, from Vietnam is most similar to the new species in lacking dorsosejugal suture, and in having long interlamellar setae, notogaster concave at posterior end, and adanal seta *ad*₃ distinctly longer than *ad*₂, but it is distinguishable from the new species by (1) the notogastral sculpture similar to the prodorsal one. (2) pteromorpha with polygonal sculpture, and (3) genital plates each with only two longitudinal scratches [20]. The other four species with longitudinal sculpture on dorsum are rather easily separated from the new species by the following features: *P. decorata* Balogh et Mahunka, 1977, from Bolivia by (1) the minute interlamellar setae, (2) the short and glabrous sensilli, and (3) the distinct dorsosejugal suture [9]. *P. complicata* Balogh et Mahunka, 1978 from Brazil by (1) the sensilli weakly thickened in the middle portion, (2) the distinct dorsosejugal suture and (3) the well visible notogastral setae [11]. *P. strigulata* Mahunka, 1978 from Maurice Island by (1) the smooth sensilli and (2) the more elongated body [17]. *P. decoratissima* Pérez-Iñigo et Baggio, 1986 from Cardoso Island by (1) the pointed rostrum, (2) the seta *le* twice as long as seta *ro*, (3) the distinct dorsosejugal suture, and (4) the larger body size (810–860 μm) [21].

Pergalumna imadatei sp. n.
(Figs. 11–13)

Measurement. Body length 527–612 μm , width 390–428 μm .

Prodorsum. Rostrum with a rounded protrusion. Prodorsum densely, but weakly punctured. Prodorsal setae thin, slightly roughened; setae *le* a little longer than half the length of their mutual distance; setae *in* directed upward, nearly as long as setae *le*. Sensillus thin, almost smooth and short, only a little longer than seta *le*. Area porosa



Figs. 11-13. *Pergalumna imadatei* sp. n. 11 Dorsal side. 12 Pteromorpha. 13 Anal region. Bar, 100 μ m.

Ad small and drop-shaped.

Notogaster. Dorsosejugal suture absent. Shape of notogaster rather elongated. Three pairs of areae porosae very small and nearly circular, mostly of the same size, but often A_1 somewhat larger than the other areae porosae; area porosa A_1 , lyrifissure im , lateroabdominal gland opening gla and seta r_3 situated close together. A pair of groups of several clear light spots found behind setae ms ; more numerous indistinct light spots of irregular shapes located peripherally and also between areae porosae Aa and A_1 . No central pore exists. Anterior portion of pteromorpha showing fine and dense wrinkles and light spots near the margin.

Anogenital region. Genital plates smooth on the surface. Genital setae g_5 and g_6 close together, inserted near the anterior margin of genital plate; distance between g_1 and g_2 as well as that between g_2 and g_3 wide; distance between g_3 and g_4 as well as that between g_4 and g_5 short. Mutual distance $ag-ag$ shorter than width of genital aperture. Anal plate finely punctured and somewhat darker than ventral plate around it. Adanal fissure *iad* close

and parallel to lateral margin of anal plate. Adanal seta ad_3 located in a level anterior to *iad*.

Holotype and 3 paratypes: Tropical rain forest (secondary forest) in Xishuangbanna Tropical Botanic Garden, Menglun (xi-3), 28-X-1992. Collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9217) and 2 paratypes (SIE-Ori 9218-9219) are deposited in the collection of Shanghai Institute of Entomology, Shanghai and 1 paratype (NSMT-Ac 10456) in the collection of National Science Museum, Tokyo.

Remarks. Having small areae porosae, *Pergalumna mauriti* Mahunka, 1978 from Maurice Island, *P. sulcatomarginata* Mahunka, 1986 from Kenya and *P. kotschy* Mahunka, 1989 from Vietnam show resemblance to the new species, but their sensilli are finely barbed, not almost glabrous as those of the new species [7, 19, 20]. Mutual distance of areae porosae Aa is short in the species in comparison, shorter than, or at most equal to, the mutual distance of notogastral setae ms , while the mutual distance of Aa in the new species is longer than that of setae ms (distance [$Aa-Aa$] = $1.37 \times [ms-ms]$). The name of the new species is

dedicated to Prof. Gentaro Imadaté of Tokyo Medical and Dental University, who made an initial and important contribution to organize the Sino-Japanese cooperative project on soil zoology.

Pergalumna magnipora xishuangbanna subsp. n.
(Figs. 14–18)

Measurement. Body length 822–833 μm , width 618–650 μm .

Prodorsum. Rostral seta *ro* weakly barbed; setae *le* and *in* thin and slightly barbed, nearly equal in length; setae *in* half as long as their mutual distance, inserted in a dark-colored ring almost contiguous to dorsophragmatic apophysis. Area porosa *Ad* elongate, situated lateral to these organs. Sensillus thin, setiform and nude, without barbation, longer than seta *in*. In lateral view, a faint network of polygonal structures found between carina *S* and tutorium (Fig. 14).

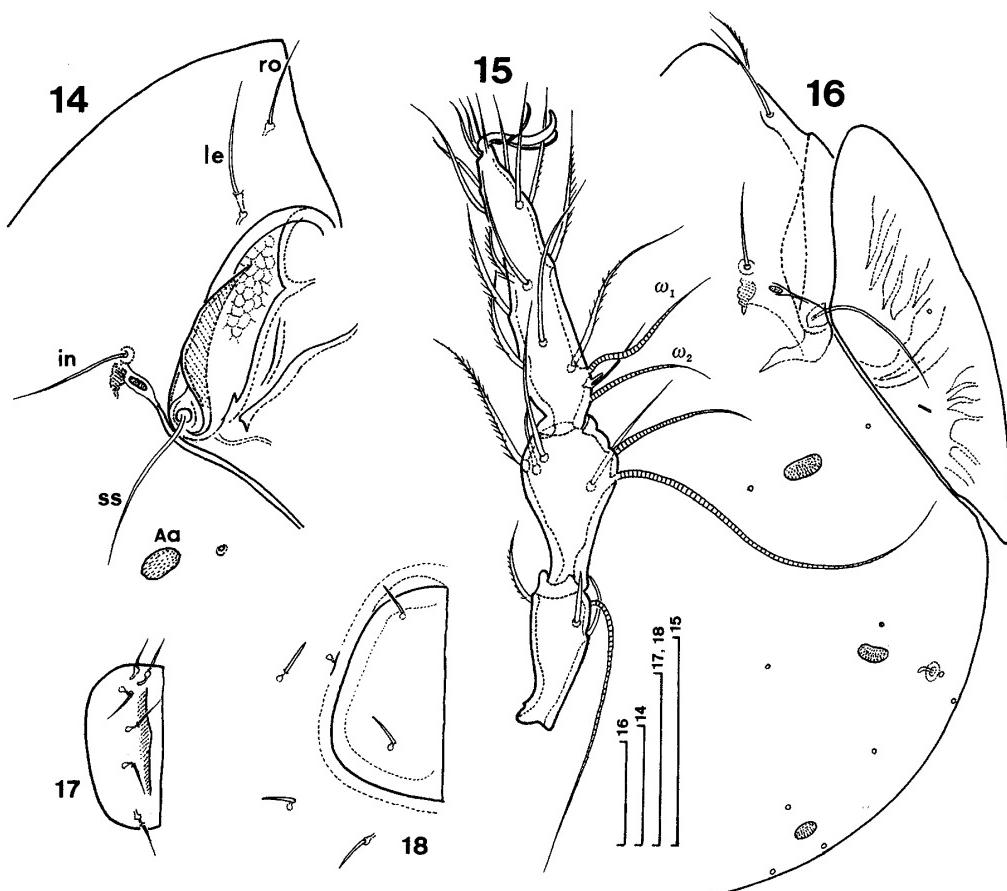
Notogaster. Surface glabrous. No notogastral

setae visible, only their alveoli detected. Three pairs of areae porosae: *Ad* and *A₁* elongate oval, *A₃* rounded and smaller than the formers; *Aa* and *A₁* not so different in size, sometimes *Aa* a little larger than *A₁*, sometimes vice versa. Pteromorpha with dark-colored radiating pattern.

Anogenital region. Formula of anogenital setae: 6–1–2–3. Genital plate with a dark longitudinal ridge near the median margin of the plate (Fig. 17). Genital seta *g₁* on the posterior margin, *g₅* and *g₆* on the anterior margin, and *g₂–g₄* arranged lateral to the longitudinal ridge. Anal and adanal setae rather thick. Adanal fissure *iad* located in a level a little anterior to seta *ad₃*.

Legs. Solenidion *ω₁* on tarsus I waving in S-shape in basal portion (Fig. 15). All legs heterotridactyle.

Holotype and 1 paratype: Tropical limestone forest (natural forest) in Menglun, Xishuangbanna (xi-4), 30-X-1992.—5 paratypes: Tropical rain forest (natural forest) in Xishuangbanna Tropical



Figs. 14–18. *Pergalumna magnipora xishuangbanna* subsp. n. 14 Lateral view of the anterior half of body. 15 Leg I. 16 Dorsal side. 17 Genital plate. 18 Anal plate and adanal setae. Bars, 100 μm .

Botanic Garden, Menglun (xi-1, xi-2), 28-X-1992.
All collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9220) and 4 paratypes (SIE-Ori 9221–9224) are deposited in the collection of Shanghai Institute of Entomology, Shanghai and 2 paratypes (NSMT-Ac 10457–10458) in the collection of National Science Museum, Tokyo.

**Key to the Subspecies of
Pergalumna magnipora (Hammer, 1961)**

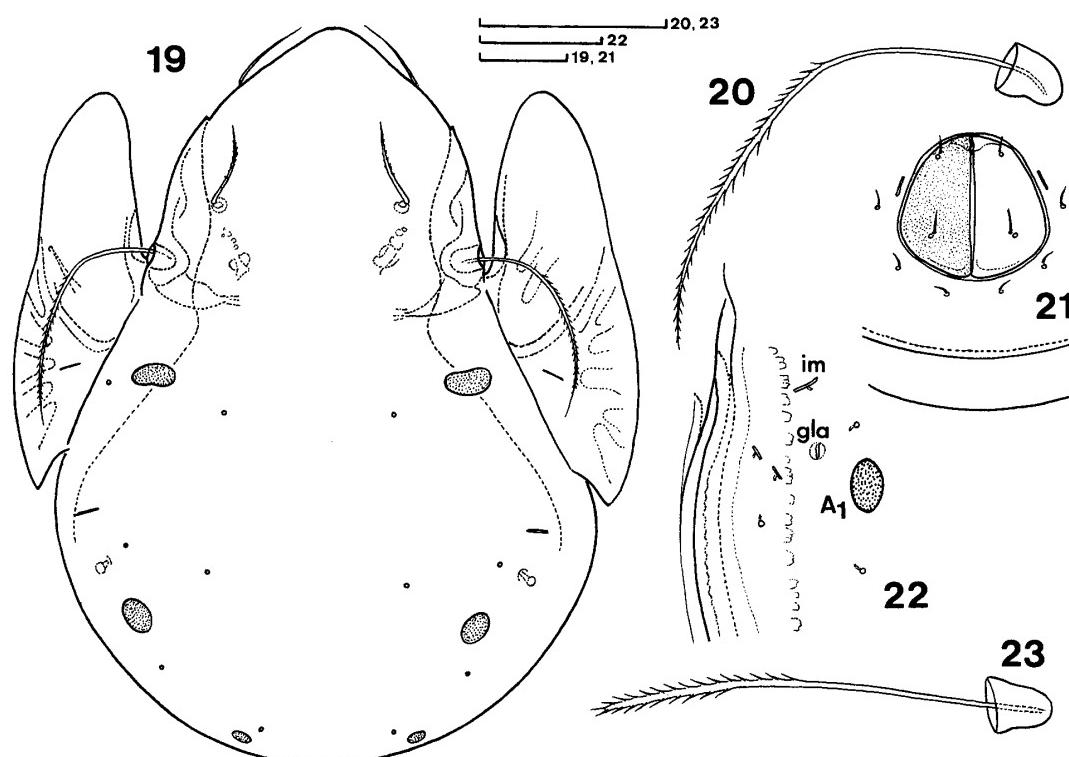
- 1 Posterior part of prodorsum finely striped; central pore found on notogaster; four small protruding knots and some short thick hairs on the posterior part of notogaster; $750 \times 598 \mu\text{m}$; Peru *P. magnipora magnipora* Hammer, 1961 [14]
- Posterior part of prodorsum glabrous; no central pore on notogaster; neither knots nor hairs on the posterior part of notogaster 2
- 2 Sensillius distinctly barbed; areae porosae A_a and A_1 very large and strongly elongated; $576 \times 426 \mu\text{m}$; South Africa *P. magnipora xishuangbanna* subsp. n.

- magnipora capensis* Engelbrecht, 1972 [13]
— Sensillus glabrous; areae porosae not so large and elongated (A_a at most 4X as long as wide) 3
- 3 Areae porosae A_a distinctly longer than A_1 ; interlamellar setae about 1/3 as long as their mutual distance; genital plates without longitudinal ridges; $742-845 \times 589-653 \mu\text{m}$; Japan *P. magnipora capillaris* Aoki, 1961 [1]
 - Areae porosae A_a not so different in shape from A_1 ; interlamellar setae half as long as their mutual distance; genital plates each with a dark-colored longitudinal ridge; $822-840 \times 618-650 \mu\text{m}$; South China *P. magnipora xishuangbanna* subsp. n.

***Pergalumna intermedia retroversa* subsp. n.**
(Figs. 19–22)

Measurement. Body length $390-435 \mu\text{m}$, width $282-315 \mu\text{m}$.

Very close to the nominate subspecies, *Pergalumna intermedia intermedia* Aoki, 1963 of Japan



Figs. 19–22. *Pergalumna intermedia retroversa* subsp. n. 19 Dorsal side. 20 Sensillus. 21 Anal region. 22 Areae porosa A_1 and its vicinity (in lateral view).

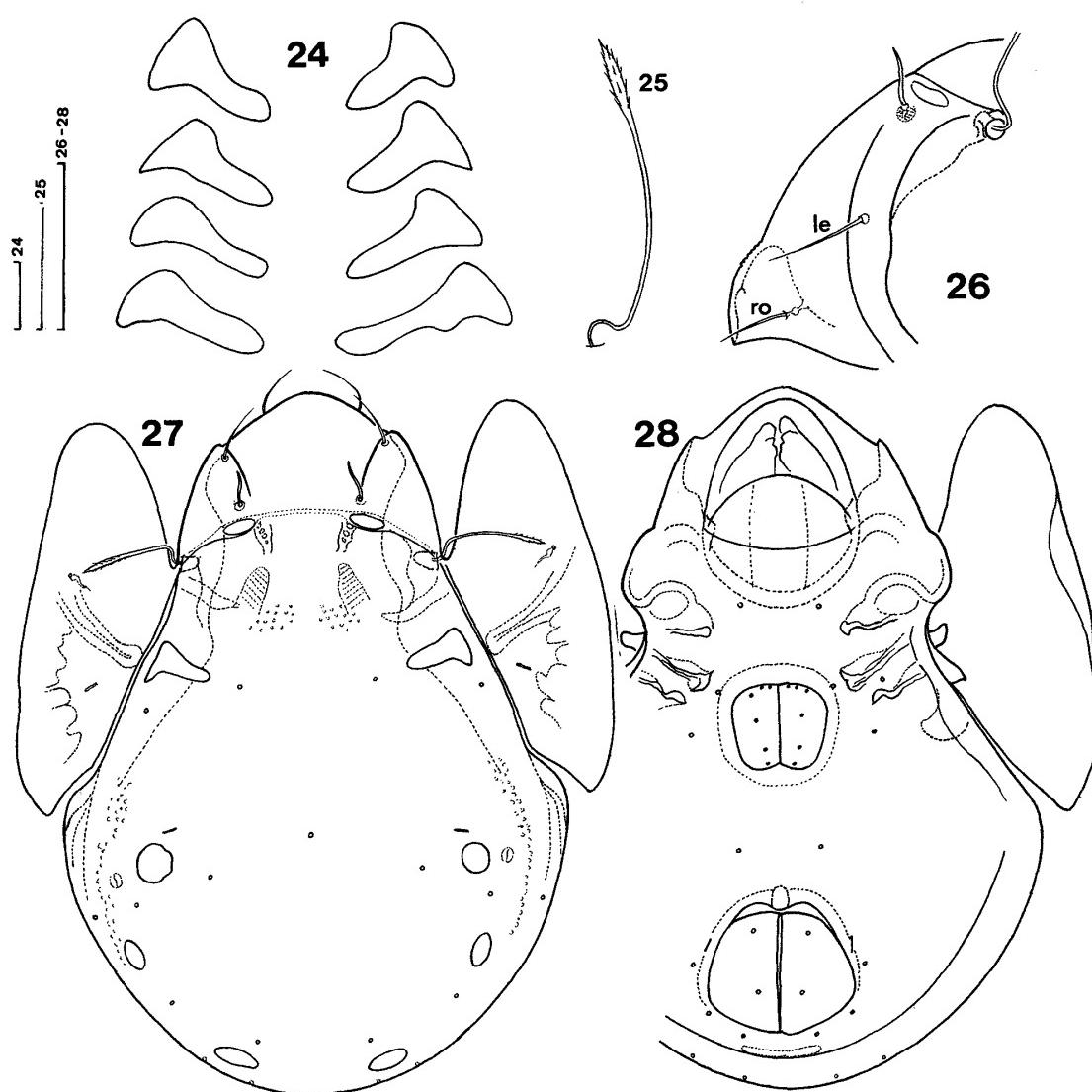
Fig. 23. *Pergalumna intermedia intermedia* Aoki 1963. Sensillus. Bars, $50 \mu\text{m}$.

[2], but differing from this in the longer and more slender sensilli strongly bending backward (compare Figs. 20 and 23). Rostral setae very short and invisible in dorsal aspect. Genital plate with 2–3 longitudinal striae as in the nominate subspecies. *Pergalumna jongkyui* Choi, 1986 from Korea is similar to the new subspecies in having long and bending sensilli, but its notogastral areae porosae are very large, especially the posteriormost ones [12]. *Pergalumna parva* Pérez-Iñigo et Baggio, 1986 from Brazil bears also similar sensilli, but it differs from the new subspecies in the presence of 4 pairs of areae porosae, reduced interlamellar setae (only their alveoli visible), the presence of postanal area porosa *Ap*, adanal setae *ad*₃ located

a little anterior to adanal fissure *iad* and the smaller body size ($276\text{--}348 \times 228\text{--}300 \mu\text{m}$) [21].

Holotype and 11 paratypes: Tropical rain forest (natural forest) in Xishuangbanna Tropical Botanic Garden in Menglun (xi-2), 28-X-1992. Collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9225) and 6 paratypes (SIE-Ori 9226–9231) are deposited in the collection of Shanghai Institute of Entomology, Shanghai and 5 paratypes (NSMT-Ac 10459) in the collection of National Science Museum, Tokyo.

Galumna weni sp. n.
(Figs. 24–28)



Figs. 24–28. *Galumna weni* sp. n. 24 Areae porosae *Aa* showing their variation in shape. 25 Sensillus. 26 Lateral view of prodorsum. 27 Dorsal side. 28 Ventral side. Bars, $50 \mu\text{m}$.

Measurement. Body length 515–520 μm , width 362–370 μm .

Prodorsum. Rostrum somewhat swelling in lateral view, with uneven surface structure in the posterior part (Fig. 26). Rostral and lamellar setae fine, *le* a little longer than *ro*. Interlamellar setae in somewhat thicker than *le*, directed upward. Carina *L* disappearing in front of seta *in*. A fairly large area porosa *Ad* situated behind seta *in*. Sensillus bearing a slender lanceolate head with barbation (Fig. 25).

Notogaster. Dorsosejugal suture indistinct, almost disappearing medially. Lateral part of notogaster in the vicinity of the posterior end of pteromorpha on each side distinctly swelling out in dorsal view (Fig. 27). Four pairs of areae porosae large; *Aa* wedge-shaped or boot-shaped (Fig. 24); *A₁* nearly circular, *A₂* and *A₃* elliptical. Lyrifissure *im* and lateroabdominal gland opening *gla* situated around *Aa*, but both the organs faint and difficult to detect. Central pore present. Pteromorpha with faint radiating pattern.

Anogenital region. Genital aperture as long as wide. Anterior genital setae arranged along the anterior margin of genital plate, *g₅* and *g₆* being very close together. Aggenital setae *ag* situated in a level mid-distance along interspace between genital and anal openings or a little more posterior; their mutual distance narrower than the width of genital opening. Anal aperture wider than long. Adanal fissure *iad* located anterior to adanal seta *ad₃*. An elongate ribbon-shaped post-anal area porosa *Ap* present.

Holotype and 3 paratypes: Tropical limestone forest (natural forest) in Menglun, Xishuangbanna (xi-4), 30-X-1992. Collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9232) and 2 paratypes (SIE-Ori 9223–9234) are deposited in the collection of Shanghai Institute of Entomology, Shanghai and 1 paratype (NSMT-Ac 10460) in the collection of National Science Museum, Tokyo.

Remarks. *Galumna monticola* Hammer, 1977 from Pakistan, *G. monteithi* Balogh et Mahunka, 1978 from Australia, *G. hamifer* Mahunka, 1985 from Guadeloupe, *G. longiporosa* Choi, 1986 from Korea and *G. changchunensis* Wen, 1987 from North China are similar to the new species in having sensilli with a weakly swollen lanceolate

head and more or less elongated areae porosae *Aa*. Among them, *G. monticola* and *G. hamifer* differ from the new species in more elongated L-shaped areae porosae *Aa* [15, 18]. On the contrary, *Aa* of *G. monteithi* and *G. changchunensis* are shorter than those of the new species [10, 23]. In *G. changchunensis*, prodorsal setae are barbed and genital plates with fine longitudinal striation [23]. Areae porosae *Aa* of *G. longiporosa* are most similar in shape to those of the new species, but the Korean species is distinguishable from the new species by (1) central pore situated behind the level of areae porosae *A₁*, (2) prodorsal setae distinctly barbed, (3) sensilli with a more distinct head, and (4) small light spots scattered in front of *A₁* [12].

The name of the new species is dedicated to Prof. Wen Zai Gen of Normal Bethune University of Medical Sciences in Changchun, who reported for the first time orbatid mites from Yunnan Province [22].

Acrogalumna bipartita sp. n.

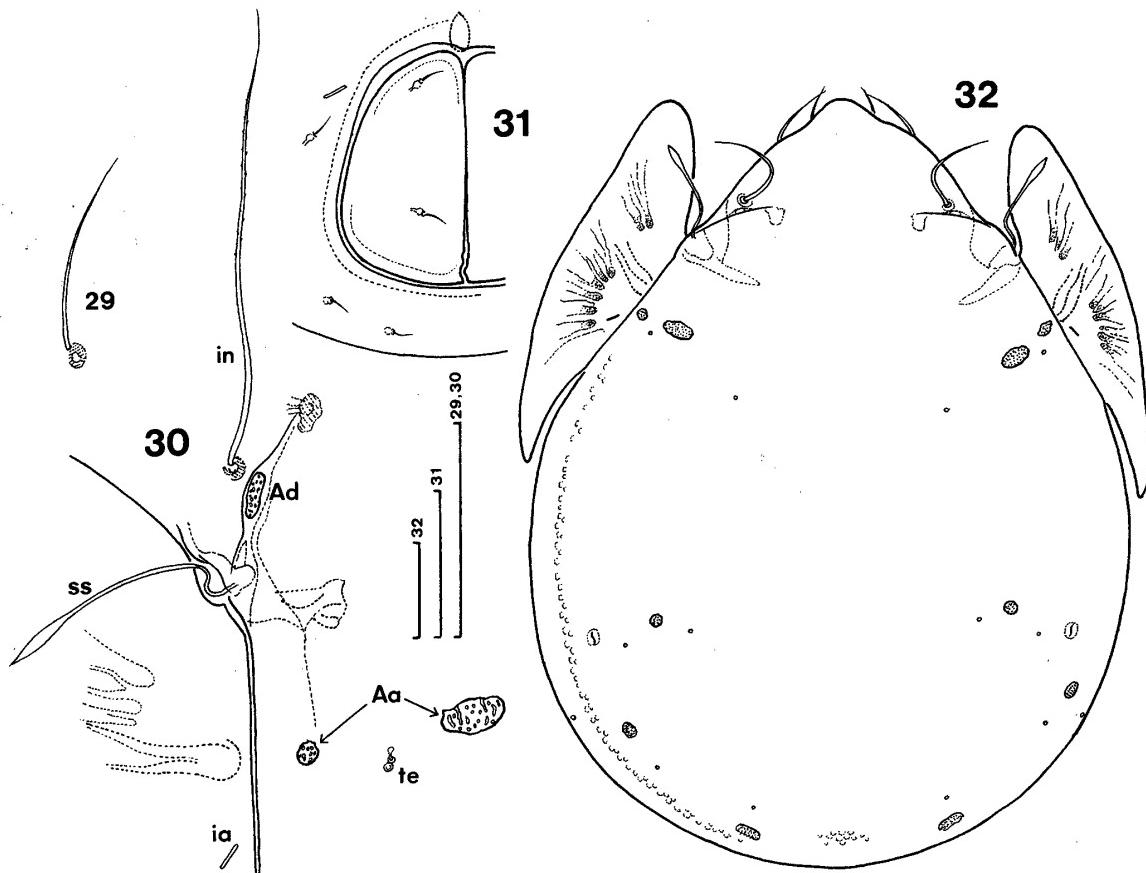
(Fig. 29–32)

Measurement. Body length 760–765 μm , width 600–610 μm .

Prodorsum. Prodorsal setae much different in length from one another; seta *in* very long and slightly roughened, more than twice as long as *le*; seta *ro* very short and fine, about 1/3 as long as *le*. Area porosa *Ad* situated very close to insertion of seta *in*. Sensillus slender, with a small lanceolate head sharply pointed at tip, without ciliation (Fig. 30).

Notogaster. Dorsosejugal suture interrupted medially between dorsophragmatic apophyses (*hy*). Notogaster appearing to be much larger than comparatively small prodorsum. Notogastral setae invisible, only their alveoli discernible. Five pairs of areae porosae rounded or oval, but irregular in outline and pores inside also irregular in shape and large (Fig. 30); *Aa* divided into two parts, the lateral one small and the median one elliptical and the largest; *A₁* and *A₂* rounded, smaller than elongate *A₃* (Fig. 32). A series of light spots arranged peripherally on notogaster.

Anogenital region. Formula of anogenital setae:



FIGS. 29–32. *Acrogalumna bipartita* sp. n. 29 Lamellar seta. 30 Sensillus, area porosa *Aa* and their vicinity (left side). 31 Anal region. 32 Dorsal side. Bars, 100 μ m.

6–1–2–3. All the setae short and fine. Two anterior setae of 6 genital setae inserted on the anterior margin of genital plate. Adanal setae *ad*₁ and *ad*₂ situated behind, *ad*₃ lateral to anal opening. Adanal fissure *iad* aligned obliquely and located in front of seta *ad*₃ (Fig. 31). Legs heterotridactyle.

Holotype and 1 paratype: Tropical rain forest (natural forest) in Xishuangbanna Tropical Botanic Garden in Menglun (xi-1), 28-X-1992. Collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9235) is deposited in the collection of Shanghai Institute of Entomology, Shanghai and 1 paratype (NSMT-Ac 10461) in the collection of National Science Museum, Tokyo.

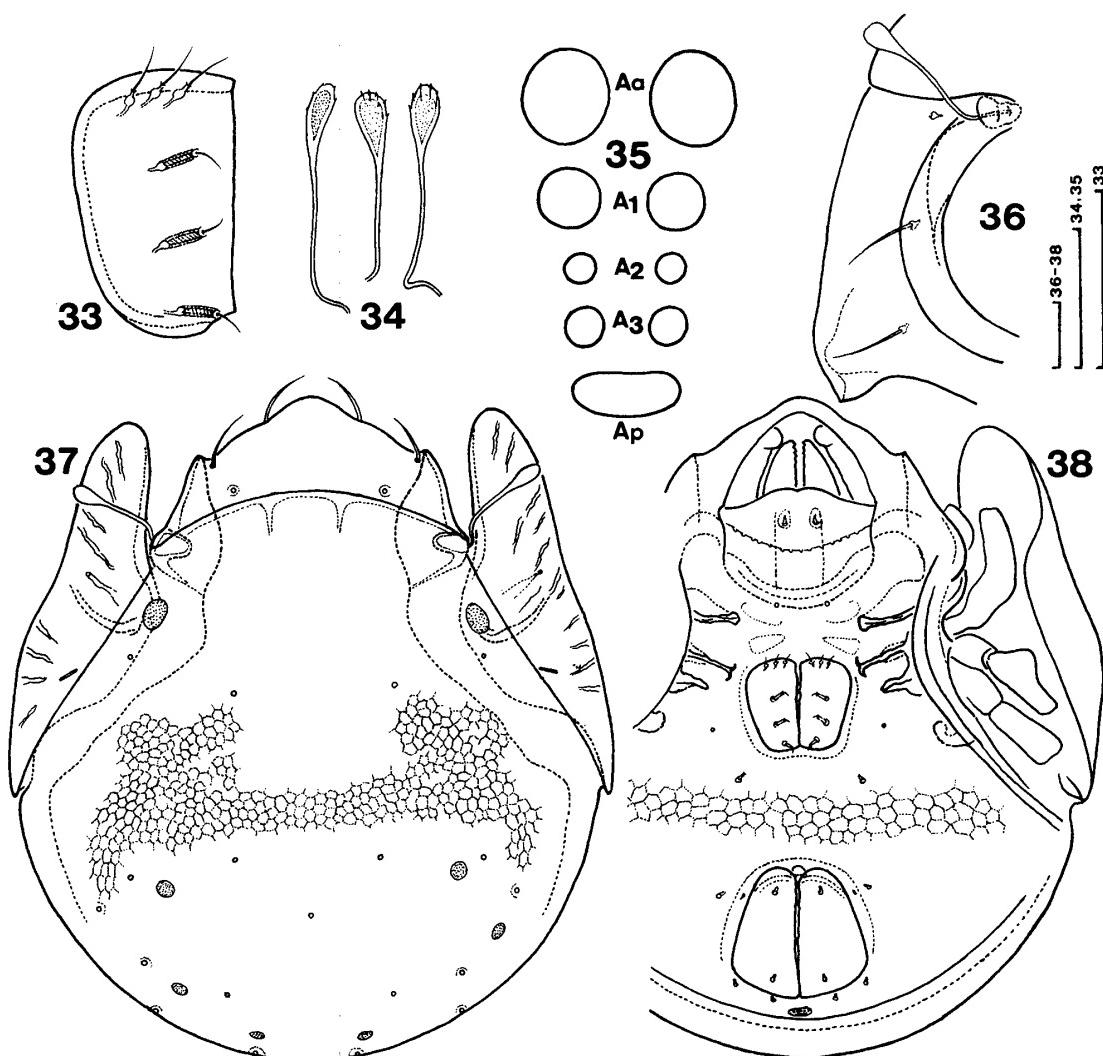
Remarks. *Acrogalumna shogranensis* Hammer, 1977 from Pakistan has sensilli with a lanceolate head as in the new species, but is distinguishable from the new species by (1) the areae porosae *Aa* undivided and elongated in the direction parallel

to lateral margin of notogaster, (2) the larger sensilli bending backward, and (3) the adanal fissure *iad* and adanal seta *ad*₃ arranged nearly side by side [15]. *A. macahdoi* Balogh, 1960 from Congo has setiform sensilli with distinct barbation [5], but the specimens collected later in South Africa by Engelbrecht [13] have sensillar head which is incrassate and tapering to apex. In both the forms the sensilli are distinctly barbed, areae porosae *Aa* not divided into two parts and they differ from the new species.

Cosmogalumna imperfecta sp. n.
(Figs. 33–38)

Measurement. Body length 326–365 μ m, width 276–287 μ m.

Prodorsum. Prodorsal setae invisible, only their alveoli discernible. Sensillus directed toward lateral or lateroanterior direction, bearing a clavate



Figs. 33-38. *Cosmogalumna imperfecta* sp. n. 33 Genital plate. 34 Sensilli. 35 Areae porosae on notogaster and ventral plate. 36 Lateral view of prodorsum. 37 Dorsal side. 38 Ventral side. Bars, 30 μ m.

head with tiny barbs apically (Fig. 34).

Notogaster. Middle part of notogaster decorated with polygonal network in part as in Fig. 37, the remaining part glabrous. Notogastral setae invisible, only 10 pairs of alveoli being discernible. Four pairs of areae porosae circular in shape; *Aa* twice as large as *A₁*; *A₂* the smallest. Central pore found between areae porosae *A₁*. Pteromorphae glabrous, without polygonal network.

Anogenital region. Formula of anogenital setae: 6-1-2-3. Genital setae *g₁*, *g₂* and *g₃* appearing to be thick and dark-colored, but a close examination reveals that they each have a dark-colored inner capsule and a fine seta is inserted at the end of the capsule (Fig. 33); setae *g₄*, *g₅* and *g₆* normal,

longer than the former setae, arranged along the anterior margin of genital plate. Aggenital, anal and adanal setae seemingly have also capsules, but not so long and distinct as in the case of genital setae *g₁-g₃*. Adanal setae *ad₁* and *ad₂* inserted behind anal aperture, but *ad₃* far anteriorly in the level of *an₂*. Adanal fissure *iad* very small, situated between *ad₃* and lateral margin of anal plate. Area porosa postanalis elongate oval. Ventral plate ornamented with polygonal network only in part as in Fig. 38, the network being arranged like a transverse band between genital and anal apertures.

Holotype and 5 paratypes: Tropical rain forest (natural forest) in Xishuangbanna Tropical Bota-

nic Garden, Menglun (xi-1), 28-X-1992.—7 paratypes: the same locality and the same collecting date (xi-2).—13 paratypes: Tropical rain forest (secondary forest) in Xishuangbanna Tropical Botanic Garden, Menglun (xi-3), 28-X-1992.—24 paratypes: Tropical limestone forest (natural forest) in Menglun, Xishuangbanna (xi-4 and xi-5), 30-X-1992. J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9236) and 46 paratypes (SIE-Ori 9237–9255) are deposited in the collection of Shanghai Institute of Entomology, Shanghai and 10 paratypes (NSMT-Ac 10462–10463) in the collection of National Science Museum, Tokyo.

Remarks. The type species of the genus, *Cosmogalumna ornata* Aoki, 1988 from Tokara Islands (South Japan) differs from the new species in (1) notogaster wholly covered by polygonal network and (2) granules covering pteromorphae and those surrounding notogastral areae porosae [3].

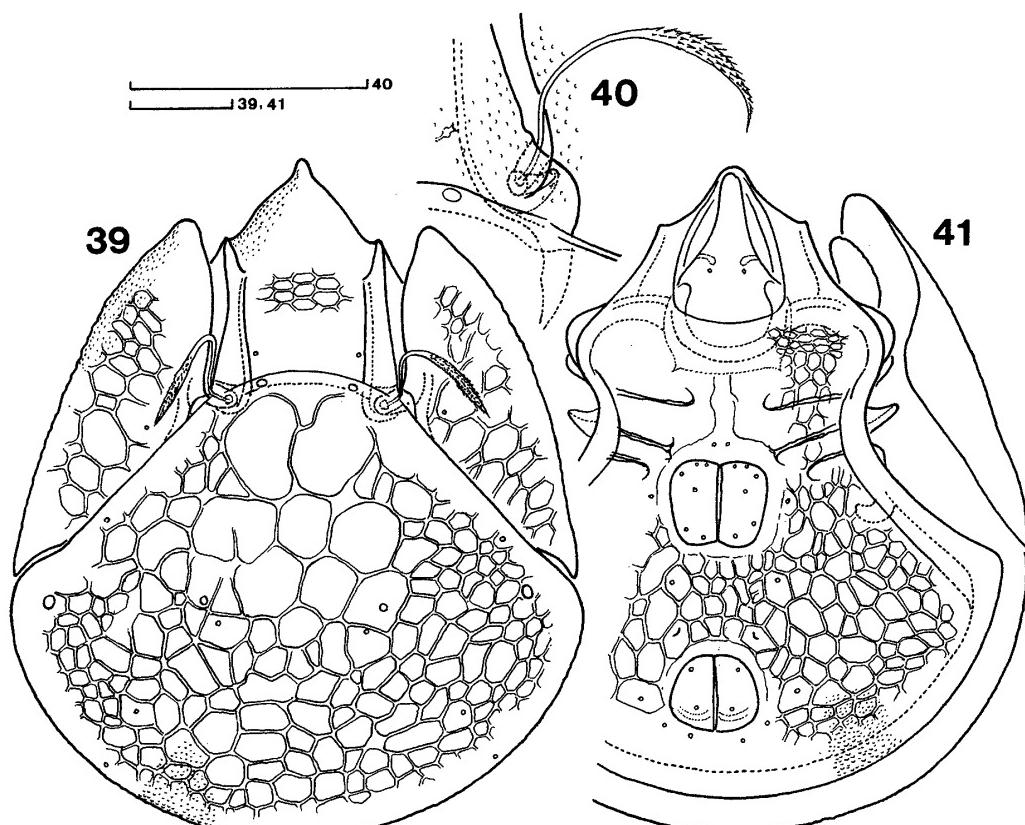
Family Galumnellidae

Porogalumnella pulchella sp. n. (Figs. 39–41)

Measurement. Body length 302(323)355 μm , width 242(265)288 μm .

Prodorsum. Rostrum projecting. Prodorsum showing indistinct polygonal network in the middle part and fine granules on the whole surface. Lamellar seta invisible, but its insertion pore situated between lines L and S. Interlamellar seta also invisible, its pore found close to the median margin of lamellar ridge. Sensillus strongly curved, bending backward, distal portion weakly swollen and densely barbed, tip sharply pointed (Fig. 40). Posterolateral margin of prodorsum behind bothridium rounded and swelling out (Fig. 40).

Notogaster. Notogaster nearly as long as wide, anterior margin being weakly arched. Whole surface covered by fine granules and a network of polygons of different sizes and shapes; a pair of



Figs. 39–41. *Porogalumnella pulchella* sp. n. 39 Dorsal side. 40 Sensillus and its vicinity. 41 Ventral side. Bars, 50 μm .

polygons just behind dorsosejugal suture the largest; cells of polygonal network becoming smaller toward posterior and marginal parts. Two pairs of small, but distinct areae porosae; one pair near the middle part of notogaster and the other on the lateral part, the former being smaller than the latter. A pair of areae porosae dorsosejugales (*Ad*) found near the anterior margin of notogaster. Pteromorpha also decorated with polygonal network except on the anterior and the posterior parts; fine granules covering whole surface of pteromorpha.

Anogenital region. Genital aperture larger than anal one. Genital and anal plates covered with fine granules, without ornamentation of polygonal network. Anogenital setal formula: 6-1-2-3. Genital setae g_5 and g_6 close together, inserted near anterior margin of the plate, g_4 somewhat lateral and posterior in position, g_3 somewhat anterior to the mid-point of the plate, g_1 and g_2 near the posterior margin. Anal seta an_2 located near the anterolateral corner of anal plate and an_1 fairly remote from the posterior margin. Adanal setae ad_1 , ad_2 and ad_3 arranged almost in a straight line. Adanal fissure *iad* located anterior to anal aperture. A very small area porosa *Ap* located posterior to anal opening, fairly distant from this. Ventral plate except in posterior part ornamented with polygonal network.

Holotype and 22 paratypes: Tropical limestone forest (natural forest) in Menglun, Xishuangbanna (xi-5), 30-X-1992.—1 paratype: the same locality and the same collecting date (xi-4). All collected by J. Aoki and S.-h. Hu. The holotype (SIE-Ori 9256) and 17 paratypes (SIE-Ori 9257-9261) are deposited in the collection of Shanghai Institute of Entomology, Shanghai and 6 paratypes (NSMT-Ac 10464) in the collection of National Science Museum, Tokyo.

Remarks. In both the genera *Galumnella* and *Porogalumnella* there are many species with polygonal ornamentation on notogaster. Presence or absence of notogastral areae porosae dividing both the genera is, however, often difficult to determine because of their very small size as well as dark color and strong ornamentation of notogaster. From this reason, the key presented here includes the species of both the genera for practical use.

Key to the Species of the Genera *Galumnella* and *Porogalumnella* with Polygonal Sculpture on Notogaster

- 1 Notogastral setae long and well visible; a median longitudinal groove on notogaster; $410-422 \times 320-344 \mu\text{m}$; India *Progalumnella setosa* Balakrishnan et Haq, 1982 [4]
- Notogastral setae invisible; no median groove on notogaster 2
- 2 Pteromorphae without polygonal sculpture 3
- Pteromorphae with polygonal sculpture 7
- 3 Pteromorphae foveolate 4
- Pteromorphae punctured 5
- 4 Pteromorphae wholly foveolate; $344 \times 277 \mu\text{m}$; Congo *Galumnella rugosa* Balogh, 1960 [5]
- Pteromorphae foveolate in the middle part, but only punctured in marginal part; $242 \times 210 \mu\text{m}$; Congo *Galumnella regosula* Balogh, 1960 [5]
- 5 Rostrum with a rounded protrusion; $299 \times 235 \mu\text{m}$; New Guinea *Galumnella woschitzi* Balogh, 1970 [7]
- Rostrum without protrusion 6
- 6 Sensillus with a weakly swollen head; polygonal sculpture on notogaster changing to longitudinal striation in the anterior part behind dorsosejugal suture; $208 \times 150 \mu\text{m}$; New Guinea *Porogalumnella quadriporosa* Balogh, 1968 [6]
- Sensillus without swollen head; polygonal sculpture on notogaster not becoming striation behind dorsosejugal suture; $240-260 \times 206-210 \mu\text{m}$; Congo *Galumnella punctipennis* Balogh, 1960 [5]
- 7 Notogaster, pteromorphae and ventral plate sculptured with polygonal network and scattered foveolae; restrum without protrusion; $275 \times 195 \mu\text{m}$; Vietnam *Galumnella cellularis* Balogh et Mahunka, 1967 [8]
- Notogaster, pteromorphae, ventral plate and also prodorsum sculptured with polygonal network and dense punctures; rostrum with a pointed protrusion; $302-355 \times 242-288 \mu\text{m}$; South China *Porogalumnella pulchella* sp. n.

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REFERENCES

- 1 Aoki J (1961) On six new oribatid mites from Japan. *Jpn J Sanit Zool* 12: 233–238
- 2 Aoki J (1963) Einige neue Oribatiden aus dem kaiserlichen Palastgarten Japans. *Annot Zool Japon* 36: 218–224
- 3 Aoki J (1988) Oribatid mites (Acari: Oribatida) from the Tokara Islands, southern Japan—II. *Bull Biogeogr Soc Jpn* 43: 31–33
- 4 Balakrishnan MM, Haq MA (1982) A new species of *Porogalumnella* (Acari: Oribatei: Galumnellidae) from Kerala, India. *Ind J Acar* 7: 20–25
- 5 Balogh J (1960) Oribates (Acari) nouveaux d'Angola et du Congo Belge. *Publ Cult Co Diam Ang Lisboa* (51): 13–40
- 6 Balogh J (1968) New oribatids (Acari) from New Guinea. *Acta Zool Acad Sci Hung* 14: 259–285
- 7 Balogh J (1970) New oribatids (Acari) from New Guinea. II. *Acta Zool Acad Sci Hung* 16: 291–344
- 8 Balogh J, Mahunka S (1967) New oribatids (Acari) from Vietnam. *Acta Zool Acad Sci Hung* 13: 39–74
- 9 Balogh J, Mahunka S (1977) New data to the knowledge of the oribatid fauna of Neogea (Acari). I. *Acta Zool Acad Sci Hung* 23: 1–28
- 10 Balogh J, Mahunka S (1978) Data on the oribatid fauna of Australia. *Opusc Zool Budapest* 15: 31–49
- 11 Balogh J, Mahunka S (1978) New data to the knowledge of the oribatid fauna of the Neogea (Acari). II. *Acta Zool Acad Sci Hung* 24: 266–299
- 12 Choi S-S (1986) The oribatid mites (Acari: Cryptostigmata) of Korea (8). *Korean Acarology* 2: 47–53
- 13 Engelbrecht CM (1972) Galumnids from South Africa (Galumnidae, Oribatei). *Acarologia* 14: 109–140
- 14 Hammer M (1961) Investigations on the oribatid fauna of the Andes Mountains. II. Peru. *Biol Skr Dan Vid Selsk* 13(1): 1–157, pls 1–43
- 15 Hammer M (1977) Investigations on the oribatid fauna of North-west Pakistan. *Biol Skr Dan Vid Selsk* 21(4): 1–72, pls 1–34
- 16 Hu S-H, Aoki J (1993) Oribatid mites from tropical forests of Yunnan Province in China. I. Family Lohmanniidae. *Proc Jpn Soc Syst Zool* (48): (In press)
- 17 Mahunka S (1978) Neue und interessante Milben aus dem Genfer Museum XXXIV. A compendium of the Oribatei (Acari) fauna of Mauritius, Reunion and the Seychelles Is. II. *Rev Suisse Zool* 85: 307–340
- 18 Mahunka S (1985) Neue und interessante Milben aus dem Genfer Museum LVII. Oribatida americana 9: Antilles I (Acari). *Rev Suisse Zool* 92: 119–144
- 19 Mahunka S (1986) Studies on the oribatid fauna of Kenya (Acari: Oribatida) II. *Folia Ent Hung* 47: 77–102
- 20 Mahunka S (1989) A survey of the oribatid fauna (Acari) of Vietnam, III. *Folia Ent Hung* 50: 47–59
- 21 Pérez-Iñigo C, Baggio D (1986) Oribates edaphique du Brasil (III). Oribates de l'Ile du Cardoso (deuxième partie). *Acarologia* 27: 163–179
- 22 Wen Z-G (1985) Two new oribatid mites from Yunnan Province. *Proc Normal Bethune Univ Med Sci* 11: 588–591 (In Chinese, with English summary)
- 23 Wen Z-G (1987) Two new oribatid mites from China (Acarina: Oppiidae and Galumnidae). *Acta Zootaxonomica Sinica* 12: 61–64 (In Chinese, with English summary)